

LIQUID COOLED RADIATION MOULE FOR SERVERS

FIELD OF THE INVENTION

The present invention relates to a liquid cooled radiation
5 module for servers and particularly to a liquid cooled
radiation module adopted for use on computer hosts housed in
servers of general industrial 1U or 2U standards that otherwise
are not suitable to apply liquid cooling due to space
constraint.

10 BACKGROUND OF THE INVENTION

Concentration of central processor unit (CPU) has been
grown constantly, and the frequency of CPU also increases as
well. The heat being radiated is very hot and in some cases
can even boil water. Following the existing trend, the present
15 air cooled radiation fins cannot fully dissipate the thermal
energy generated by the modern CPUs. Experts predict that in
the future 3 to 5 years all CPUs in the world have to use liquid
cooled apparatus. The liquid cooled apparatus have many
advantages such as strong thermal energy carrying capability
20 and desirable controllability. And thermal energy may be
transferred in a selected direction. Liquid circulation may be
achieved by a smaller amount of power consumption.
Radiation may be accomplished in various forms. The curve
of CPU operation temperature is smooth and formed in a
25 gradual shape. And operation noise of the equipment is lower.

Typical liquid cooled apparatus now available on the market can be summed up as follows:

1. External liquid cooled apparatus. It includes a water tank equipped with a pump located outside a computer host. The water tank is connected to the CPU through a water pipe. Heat generated by the CPU is carried by the liquid to the external water tank in a close loop manner. Heat dissipation is performed in the external water tank. This type of heat dissipation is most effective. However, the external water tank and the radiation module are quite bulky and take too much space. It is suitable only to large size computer hosts, and is not suitable to the general personal computers or servers.

2. Modular liquid cooled apparatus. Such type is designed based on 5.25" slot. The apparatus includes radiation fins made by aluminum extrusion and air fans. The radiation fins has four straight water passages on the bottom and two transverse water passages. The water passages are sealed by waterproof silicon paste to form a M-shaped water passage to allow water to circulate inside. It can increase contact surface and effectively transfer heat to the bottom of the radiation fins. However, as the fins have a lower height, the air fans experience a clear static pressure during operation. Such a design has the advantage of requiring only one optical disk slot. It is suitable for personal computers. However, to servers, because the space for hard disk and optical disk drive is

limited, to allocate extra space is not easy. Hence for the servers that conform to industrial 1U or 2U standards, the liquid cooled apparatus that can be directly installed in the servers is still not available.

- 5 3. Moreover, liquid circulation of the present liquid cooled radiation modules mostly have a water delivery device connecting to a liquid pipe that is driven by a pump and motor. The pump and motor generate noise during operation. It is an annoyance not well accepted by many users.

10 **SUMMARY OF THE INVENTION**

Therefore the primary object of the invention is to resolve the aforesaid disadvantages and overcome the drawbacks of the prior art. The invention is installed in a server to directly provide liquid cooled heat dissipation for the CPU. The module includes a body
15 which has a housing compartment to contain a liquid tube and a radiator. The radiator has an air sucking section to draws heated air in the housing compartment and an air discharge section to discharge through an air vent. The liquid tube includes a water delivery device to form a liquid circulation loop to continuously
20 disperse heat for the CPU. The liquid cooled radiation module thus made is compact and may be adopted on servers of 1U or 2U standards, and coupled with the operation of the water delivery device which is driven synchronously by magnetic force of an impeller of the radiator, it can achieve heat dissipation effect
25 through liquid circulation without the need of using a pump.

The foregoing, as well as additional objects, features and advantages of the invention will be more readily apparent from the following detailed description, which proceeds with reference to the accompanying drawings.

5 **BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a perspective view of the invention.

FIG. 2 is a sectional view of the invention.

FIG. 3 is a top view of the invention.

FIG. 4 is a schematic view of the invention showing the flow
10 direction of heat dissipation.

FIG. 5 is an illustrative view of the invention installed in a server.

FIGS. 6 and 7 are schematic views of another embodiment of the invention.

15 **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

Please referring to FIGS. 1 through 5, the liquid cooled radiation module for servers according to the invention is housed in a server 80 to directly disperse heat for a CPU 51
20 through a liquid cooling fashion. The module includes a body 10 which has a housing compartment, and one or more liquid tube 20 and radiator 40 located in the housing compartment. The body 10 has one end forming an air vent 11 communicating with the housing compartment. The radiator
25 has an impeller 40 bordered by an air discharge section 45 to

connect to the air vent 11 and an air sucking section 46 to draw heated air in the housing compartment. During assembly, one end of the radiator 40 has a fastening section 43 to fasten to a side wall 12 of the body 10 through fasteners 47. The liquid tube 20 is formed in a undulate manner to provide a greater amount of heat dissipation surface. The liquid tube 20 further has two ends 21 and 22 extended and exposed outside the body 10, and one or more water delivery device 30 located therein. The water delivery device 30 is a closed body corresponding to where the radiator 40 is located. The water delivery device 30 also has a liquid inlet 33 and a liquid outlet 34 connecting to the liquid tube 20. Inside the water delivery device 30, there is a water delivery member 31 corresponding to the impeller 44 of the radiator 40 and driven by the impeller 44 through a magnetic force. The liquid cooled radiation module thus made can achieve heat dissipation through liquid circulation without using a pump.

In terms of the server 80 that adopts the general industrial standards 1U or 2U, it has a common specification for height of 1.75". After a main board 50 and the CPU 51 and the radiator have been installed in the server 80, there is not spare height to accommodate the radiator 40. Hence the server 80 usually has to allocate a middle section to install an array of air fans (not shown in the drawings) for heat dissipation. Therefore, in the limited interior space of the server 80, the

invention uses the space between the power supply 70 and the main board 50 to install the liquid cooled radiation module, and installation is done in a upright manner to use the space effectively.

5 Referring to FIGS. 4 and 5, when in use, water pipes 60 are used to connect a water inlet head 522 and a water outlet head 521 of the radiation fins 52 above the CPU 51, and connect to two ends 21 and 22 of the liquid tube 20. When the radiator 40 starts operation, the impeller 44 has a coaxial rotary shaft 42
10 coupling with a first magnetic member 41. The water delivery device 30 has a second magnetic member 32 corresponding to the first magnetic member 41 with the same or opposite magnetism. According the magnetic principle of attraction of opposite magnetism or repulsion of the same magnetism,
15 when the first magnetic member 41 rotates with the impeller 44, the second magnetic member 32 also is driven to rotate and the water delivery member 31 is driven to pump water. As the liquid tube 20 and the water pipe 60 are formed in a closed loop, water can be circulated by entering from the liquid inlet
20 33 of the water delivery device 30 and discharging through the liquid outlet 34 under the thrust force generated by the water delivery member 31 (by the same principle of a water wheel). Meanwhile, liquid in the liquid tube 20 flows through the water inlet head 522 of the radiation fins 52 to absorb thermal
25 energy of the CPU 51 and exit through the water outlet head

521 and return to another end 21 into the liquid tube 20. As the liquid tube 20 is formed in a undulate manner, heat dissipation surface is enlarged. With the impeller 44 of the radiator 40 rotating, and the side wall 12 of the body 10 has
5 air intake openings 121 formed thereon, air in the housing compartment may be ventilated to accelerate airflow which enters from the air sucking section 46 of the radiator 40 and discharges through the air discharge section 45 and the air vent 11 thereby disperse heat from the liquid tube 20 to the
10 exterior. Referring to FIG. 6, in order to increase heat dissipation effect, more than two sets of radiator 40 may be used. Namely, two sets of radiators 40 and 40' are installed on two ends of the body 10. The radiator 40' is mainly to carry external airflow into the body 10 to accelerate airflow speed
15 and discharge from the radiator 40. Referring to FIG. 7, two sets of water delivery devices 30 and 30' may be coupled with two sets of radiators 40 and 40' to further accelerate liquid flow speed. Thereby thermal energy of the CPU 51 may be carried away faster to the liquid tube 20 and discharged
20 rapidly through the radiators 40 and 40'.

By means of the construction set forth above, liquid in the radiators 40 and 40', coupled with the operation of the water delivery device 30, can continuously and rapidly carry the thermal energy generated by the CPU 51 to the liquid tube 20,
25 and the radiators 40 and 40' can rapidly discharge the thermal

energy through the liquid tube 20 to the exterior. Thus the invention can effectively disperse heat of the CPU 51 through a liquid cooling fashion. Moreover, the whole module may be made in a compact size to better use the interior space of the server 80. And the server 80 that adopts the general industrial 1U or 2U standards can enjoy the benefits of liquid cooling apparatus. In addition, the invention does not need pump and motor to drive. The impeller 44 of the radiator 40 is directly driven through magnetism. Not only fabrication cost may be reduced, operation noise also is lower. Furthermore, the water delivery device 30 is closed, liquid does not leak out or evaporated. Hence even though the invention is installed in the server 80, the electronic elements do not expose to moisture and do not have the risk of short circuit or damage.

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